PATENT SPECIFICATION 909,865

DRAWINGS ATTACHED.

Inventors:—DONALD ARTHUR SHARMAN and BARRY EDWARD ADRIAN JACOBS.

Date of filing Complete Specification : May 6, 1960.

Application Date : May 8, 1959. No. 15830/59.

Complete Specification Published : Nov. 7, 1962.

Index at Acceptance :—Classes 86, C(10 : 19A2) ; 1(1), F4(C : D) ; 1(2), Q7 ; and 2(3), C3A10A(1 : 5G2).

International Classification : —B01f. C01d.

COMPLETE SPECIFICATION.

Improvements in and relating to the Mixing of Fluids.

We, COURTAULDS LIMITED, a British Company, of 16 St. Martin's-le-Grand, in the City of London, England, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement: —

This invention relates to the mixing of fluids. The term "fluids" is used in this Specification in the wide sense to include both gases and liquids, and also to include dispersions and suspensions of solid or liquid matter in a liquid or gaseous medium.

For many purposes, for example in carrying out chemical reactions, it is desirable to mix fluids to form a substantially homogeneous mixture, and mechanical mixing devices are generally used for this purpose. The present invention provides a novel form of apparatus by means of which the mixing of fluids is effected without recourse to mechanical stirring devices.

In accordance with this invention, the mixing of the fluids is effected in a cylindrical vessel and the fluids are introduced at one end of the vessel as two separate streams, one substantially diametrically across the vessel and the other substantially tangentially in the immediate vicinity of the diametrical feed. It is advantageous to arrange for the two feeds to be unequal with the greater feed being introduced as the diametrical stream. With the arrangement of this invention, the tangential flow gives a swirl motion around the vessel and the diametrical flow gives a violent "top to bottom" mixing which may be increased by arranging the diametrical flow so that it is slightly inclined towards the nearest end of the vessel.

The fluid mixture is withdrawn from the end of the cylinder opposite to the feed end and the outlet is preferably arranged so that it is directly above or below the main inlet for the diametrical feed.

An apparatus conducted according to this invention is illustrated in the drawings accompanying the Provisional Specification in which:—

Figure 1 is a plan view; and

Figure 2 a perspective view of the apparatus.

The apparatus comprises a cylindrical vessel 1 with a tangential inlet 2 and, in the immediate vicinity thereof, a diametrical inlet 3 at one end of the cylinder and an outlet 4 at the other end. As shown, the diameter of the inlet 3 is greater than that of the inlet 2.

The apparatus of this invention may be used to carry out chemical reactions between fluids, for which purpose the cylinder may be cooled or heated as required to maintain a reaction temperature in any convenient way, for example by a cooled or heated jacket. The apparatus may be used for oxidation reactions for example in the oxidation of acetaldehyde to acetic acid; for this reaction the acetaldehyde is conveniently fed through the diametrical inlet and oxygen through the tangential inlet.

The invention is illustrated by way of example first as applied to the oxidation of acetaldehyde. A cylinder 4 feet 6 inches in diameter and 5 feet high was provided with a diametrical inlet 3 of 3.5 inches diameter and a tangential inlet of 1.75 inches dia-

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meter at the base and an outlet 4 of 4 inches diameter at the top as shown in the drawing. The cylinder was maintained at about 130° C. and acetaldehyde was fed through the diametrical inlet 3 at a rate of 66 feet/sec. (corresponding to 1744lb./hour) and oxygen was fed through the tangentional inlet 2 at 26 feet/sec. (corresponding to 126 lb./hour). A vapour containing acetic acid, acetaldehyde, carbon dioxide and carbon monoxide was withdrawn from the outlet.

The apparatus of the invention is also useful for carrying out other reactions and particularly the combustion of waste liquor and effluents. One application of this invention is in the combustion of sulphite liquors obtained in wood pulping and such liquors may be efficiently burned by feeding the liquid through the diametrical inlet and air or oxygen through the tangential inlet, the cylinder being previously raised to and maintained at a suitable combustion temperature.

As an example of the disposal of black liquor from the sodium base sulphite pulping process, a cylinder 4.5 feet in diameter and 5 feet high was used. The diametrical inlet 3 was 2.5 inches in diameter, the tangential inlet 2 was 0.75 inches in diameter and the diameter of the outlet 4 was 6.5 inches. The vessel was operated with black liquor (60 per cent w/w solids) which had been finely dispersed in the recycled gas at 600° C. This mixture was fed in through the diametrical inlet 3 at a velocity of 67.5 feet/second. Air was fed into the reactor through the tangential inlet 2 at a velocity of 30 feet/second. The oxygen content of the air was just sufficient for the complete combustion of the recycled gas. With a residence time of 15 seconds within the reactor and the temperature maintained at 640° C., the components reacted to form a mixture of combustible gas, sodium carbonate and sodium sulphate. The solids were removed from the reactor in the gas stream and separated from it by means of a cyclone, so that part of this combustible gas stream could be used with the recycled gas.

WHAT WE CLAIM IS:—

1. A process for mixing fluids to form a substantially homogeneous mixture which comprises mixing the fluids in a cylindrical vessel, the fluids being introduced at one end of the vessel as two separate streams, one substantially diametrically across the vessel and the other substantially tangentially in the immediate vicinity of the diametrical feed, and withdrawing the fluid mixture from the end of the cylinder opposite to the feed end.

2. A process as claimed in Claim 1 in which the two feeds are unequal with the greater feed being introduced as the diametrical stream.

3. A process as claimed in Claim 1 or 2 in which the diametrical flow is slightly inclined towards the nearest end of the vessel.

4. A process as claimed in Claim 1, 2 or 3 in which the outlet is directly above or below the main inlet for the diametrical feed.

5. A process as claimed in any of the preceding claims which comprises heating or cooling the cylindrical vessel as required to maintain a reaction temperature.

6. A process as claimed in Claim 1 carried out substantially as described in either of the preceding examples.

7. An apparatus for mixing fluids which comprises a cylindrical vessel with a tangential inlet and a diametrical inlet in the immediate vicinity of each other at an end of the cylinder and an outlet at the other end.

8. An apparatus as claimed in Claim 7 in which the diameter of the diametrical inlet is greater than that of the tangential inlet.

9. An apparatus as claimed in Claim 7 constructed and adapted to operate substantially as shown in the drawings accompanying the Provisional Specification.

J. Y. & G. W. JOHNSON,
47 Lincoln's Inn Fields,
London, W.C.2,
Chartered Patent Agents,
Agents for the Applicants.

Abingdon: Printed for Her Majesty's Stationery Office, by Burgess & Son (Abingdon), Ltd.—1962.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2.
from which copies may be obtained.

909865 PROVISIONAL SPECIFICATION
1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

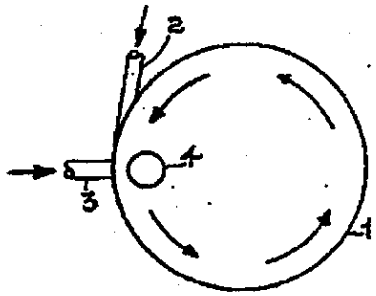

FIG. 1

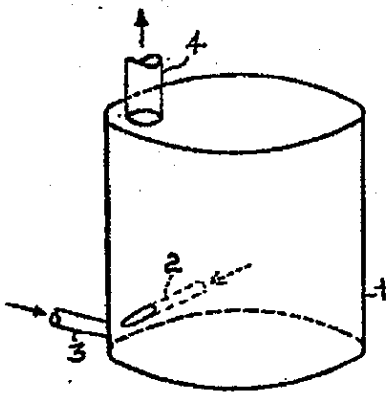

FIG. 2